New Installations

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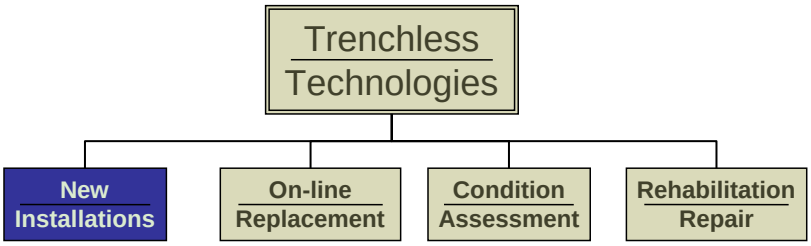
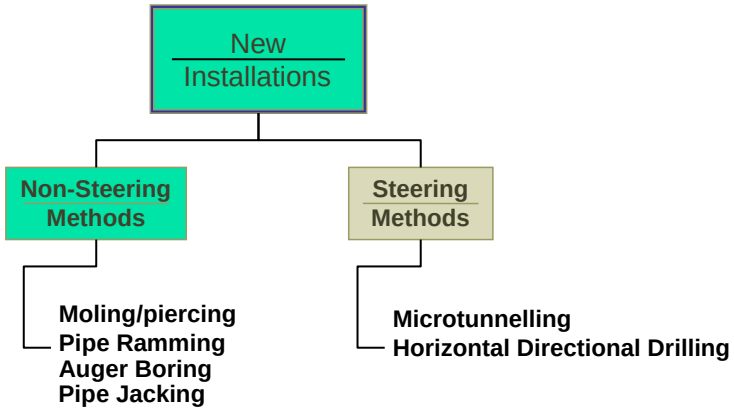
Broad Categories



New Installations



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New Installations

- Non-steering
- Steering

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New Installations

- Non-steering methods
  - Control of pipe alignment is limited to how the pipe enters the ground
  - Change in alignment is limited after the first pipe length is installed
  - Total pipeline drive length is limited to approx. 100m

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New Installations

- Steering methods
  - Operator has the ability to monitor and change the bore depth and alignment throughout the pipe installation process
  - Only gradual changes in alignment are possible
  - Short and long drive lengths possible
    - greater than 100m

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New Installations

New Installations

- Non-Steering Methods
  - Moling/Piercing
  - Pipe Ramming
  - Auger Boring
  - Pipe Jacking
- Steering Methods
  - Microtunnelling
  - Horizontal Directional Drilling

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Impact Moling/Piercing

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Impact Moling/Piercing

- Percussive mole (torpedo) is launched from a drive pit
- New pipe is normally drawn behind the mole
- Soil is displaced to form a **void** behind the mole

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Mole

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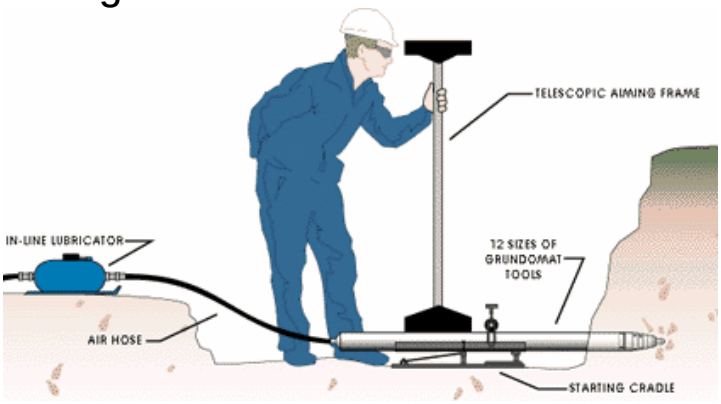
Impact Moling/Piercing

- Alignment



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Impact Moling/Piercing

- Uses compressed air or hydraulics to displace soil by the action of a compressive piston contained in a torpedo shaped casing (mole)

Soil is not removed it is compressed

In dense/stiff soils you can get ground movements

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Impact Moling/Piercing

- Soil friction on the mole is required to hold it in-place and to drive it forward
  - If no soil friction the mole will SWIM
  - Standard penetration test (SPT) blow (N values) greater than 5 is required
- Installation problems in:
  - Loose and soft soil deposits
  - Soils that contain boulders/cobbles

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Impact Moling or Piercing

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Impact Moling or Piercing

- Moles are available in a variety of sizes:
  - 45 to 580mm in diameter.
- Mainly used for the installation of small diameter gas, communication and hydro utilities (30 to 80 mm in diameter) with lengths less than 50m.
- City of Waterloo uses a mole for placement of potable waterlines under heritage trees

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Impact Moling or Piercing

- 30 to 80mm dia. pipes can be installed in a single pass
- Repetitive multiple passes have been used to install pipes 200 to 250mm dia.
- Installation rate depends on soil type and mole impact energy and size

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Two Pipe Installation Methods

Pulled in by mole:

- Air or hydraulic hoses are placed inside piping

Warning:

- Mole will exhaust an oil film on inside of pipe
- Filter bag may be used to minimize oil on inside of pipe
- Method may not be suitable for potable water lines

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Two Pipe Installation Methods

Pipe is pushed into the void (hole) by hand

- No hose placed inside piping
  - No oil film on inside of pipe
- May get ground settlement due to the collapse of the annular space between the pipe and soil

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Safety Precautions

- High pressure hoses
- Obtain utility clearances and locates before you start your project
- Confirm critical utility locations by excavation before you start
  - Do not trust drawings
  - Cost of taking out utilities can be high
    - Cable, hydro, fiber optics
- Safe drive and exit pit slopes

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Web pages for more info

- Process specifications at
- www.hammerheadmole.com
- www.tttechnologies.com
- Some other links
- CATT www.civil.uwaterloo.ca/catt
- www.cpchem.com
- www.isco-pipe.com

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Steerable Mole

- Developed by Gas Research Institute

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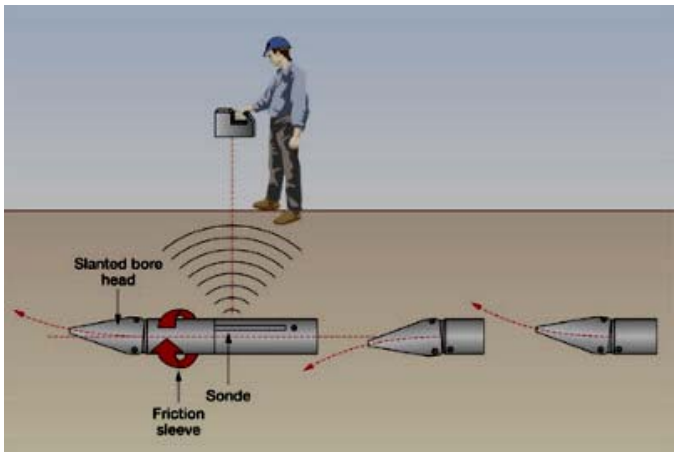
Steerable Mole



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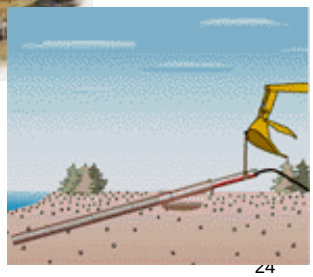
Pipe Ramming



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Pipe Ramming

- Installation of steel pipe by driving it into the ground with a pneumatic mole (hammer)
  - Horizontal pile driving
- Pipe is driven from a drive pit to exit pit
- Soil is displaced

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Thrust Boring

- Pipe is pushed hydraulically into the ground

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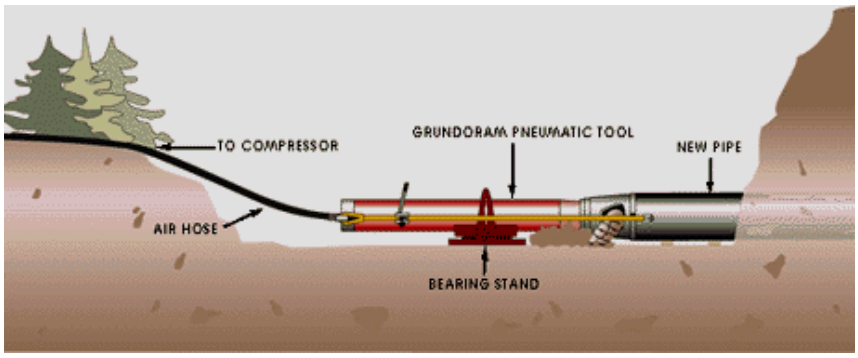
Pipe Ramming



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Pipe Ramming

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Pipe Ramming

- Pipe (casing) diameters can vary from 50 to 2000mm
- Casing is rammed in 20 (6.2) to 40ft (12.4m) segments
- After each casing is rammed another segment is welded or mechanically fitted together

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Pipe Ramming

- Steel casing may be driven open or closed ended
- <100mm (4”) OD - closed ended
  - Hard to clean out
- >100mm (6”) – open ended
- 100 to 150mm – Open or closed ended
- Steel rings welded to front of pipe
- Pipe drive lengths can approach ~100 m
  - Lubrication may be applied to the pipe surface

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Pipe Ramming

- Spoils removed from open driven casing:
  - compressed air and water
    - Clayey soils
  - Auger boring
    - Sand and silts
- Product pipe or pipes are usually inserted in the casing and then the annular space between the product pipe and casing is grouted

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Pipe Ramming

- Spoils Removal - Compressed Air

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Pipe Ramming

Typical applications:

- Pipeline installation under railway and road embankments
- Driving of casing in environmentally sensitive areas

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Pipe Ramming

- Advantages
  - Effective in soil with cobbles
  - Works well when there is a high groundwater table – do not need to dewater the bore path
  - Little or no ground movements if driven open ended
  - Proven technique

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Pipe Ramming

- Disadvantages
  - Installation problems can occur in
    - soft soils
    - soils that contain hard cobbles/boulders
    - Ground disturbance if pipe installed closed ended and at depth less than 10 times the pipe diameter
    - Ground subsidence in loose soils
  - Cost: mobilization, casing costs increase with increasing pipe wall thickness

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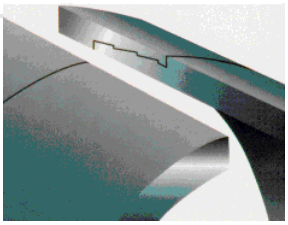
PERMALOK Casing

simple mechanical "press fit"



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PERMALOK Casing

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PERMALOK vs. WELDING

- A 24" PERMALOK connection is made in 6 minutes or less
- crew can install up to 9 pieces of casing 20’ long in 8 hours.
- 180 linear feet per day

- Best field welders take 90 minutes to fit and butt weld one joint of 24" x .500" inch casing.
- crew can install 3-4 pieces of casing 20’ long in 8 hours
- 60 to 80 linear feet per day.

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Case Study Guelph, ON

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Guelph Hydro

- Hydro for new subdivision
- Cross four lane highway
  - MTO will not permit excavation
  - Overhead tower expensive
- Site conditions:
  - Sand/gravel/cobble and boulders
  - High GWT
- Tried Auger boring 900mm (36in) dia. casing

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Guelph Hydro Project

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Guelph Hydro Project

Pneumatic Ram

Permalok pipe cushion

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Guelph Hydro Project

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Guelph Hydro Project

- 6.2m (20ft) installation time
  - 20 to 30 minutes
- Set-up per 6.2m (20ft) length
  - 3 to 4 hours

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Guelph Hydro Project

- Problem
  - Crack in cushion
  - Cushion second installation
  - Cost ~600US

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Guelph Hydro Project

- Job finished in two days
- Not voids around pipe
- On line and grade
- Augured out casing
  - Sheared boulder close to pipe diameter
- No casing damaged

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CN Railway Project

- North of Toronto
- 42inch OD Permlok
- Boulders and cobble stopped auger boring
- Need to go under CN railway

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CN Railway Project

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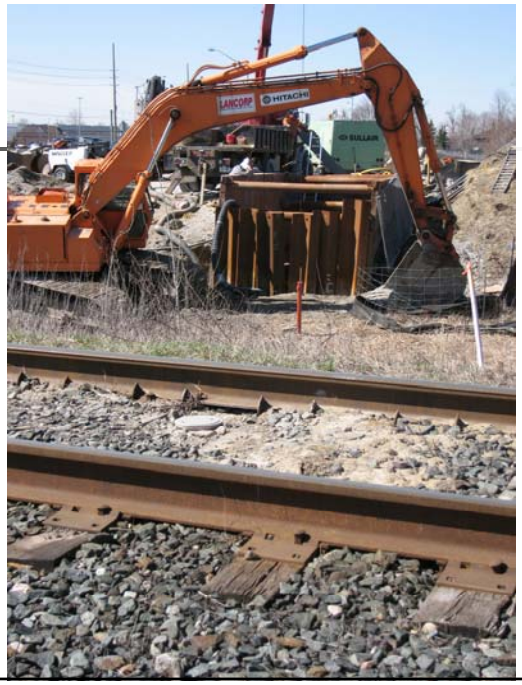

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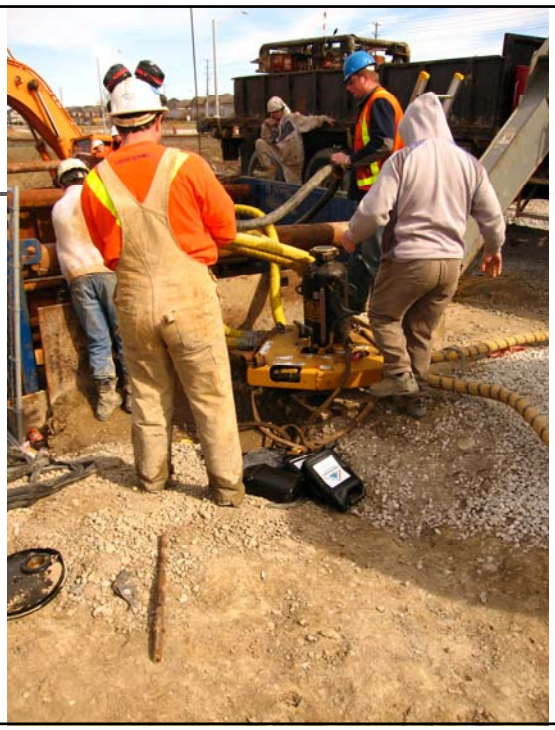

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